CORRESPONDENCE

PUBL

RELATIVE

DATE:
SIGNATURE:

TO THE

IMPROVEMENT

OF THE

COURSE AND BED

OF THE

COOUM RIVER.

PRINTED BY AUTHORITY.

MADRAS:

PRINTED AT THE MILITARY BOARD PRESS.

MDCCCLII.

REFERENCE

No. 2703.

THE MILITARY BOARD'S CIRCULAR LETTER.

Your attention has no doubt been directed to the very offensive effluvia exhaling, when the water is low, from the mud and filth in the bed of the Cooum, these have been occasioned by many causes, and which it may not now be necessary to enter upon, but to endeavour to provide a remedy for the existing evil, the orders of Government on this head are as follows :—

"The Military Board will give their early attention to the state of the Cooum River with the view of effecting, if possible, some permanent improvement in its course and bed, and the Chief Magistrate will immediately ascertain and report the extent of the nuisances, complained of in paras 5 and 6 of the Memorial of the householders and inhabitants of Madras, with the causes of their existence, and state what remedial measures he would propose for their removal, if he is not himself empowered, at once, effectually to put a stop to them."

The Military Board request that you will do them the favor to furnish them with any information you may possess that may bear on the following points, to enable the Board to lay clear and well defined facts before such experienced Officers as the Government shall see fit to select, and who will, by this means, be enabled from the mass of information which will thus be elicited, to decide upon some plan which will effect the object in view.

The Military Board do not expect that you should state your opinions or views on any of these heads; should you be kind enough to do so, they will be most gladly received; the Board's wish is, merely, that if it is in your power, you will kindly put them in possession of materials from which a plan can be constructed to carry out the object in view.

The heads under which they have thought it best to arrange the subject are as follows :—

1. Improving the course of the Cooum River.

2. Improving, i. e. deepening its bed.

3. Preserving a certain head of water all the year round by a more perfect communication with the Pulicat and Ennore Lakes and the Cooum River.

4. Preserving a certain head of water all the year round by means of the Rivers round Madras, within a circle of 20 or 30 miles, being diverted into Tanks or to have bunds thrown across them where sufficient supply of water could be remaintained to replenish the Cooum, the communication with Ennore, being, if necessary, cut off.

5. Opening and keeping open the Cooum Bar so as to admit of the rise and fall of the tide.

I. For the first of these heads if you could favour the Board with such information as would enable them to call for plans, sections and rough estimates of expense, they would be much obliged.

II. For the second, an allusion to Hill's Map of Madras with any suggestions as to whether the deepening had better be effected by dredging or digging, will be gratefully received, and its value would be enhanced by such a specification, or suggestions, as would enable the Board to call for estimates and sketches.

III. For the third, such information or suggestions as you may be able to favour the Board with, to enable them to have plans, estimates and specifications prepared.

IV. For the fourth, a memo. stating the Rivers, Nullahs, Tanks or Water courses proposed to be dammed up or to have channels cut from them, stating also where the regulating sluices will be placed with a specification of the manner in which the work should be effected.

V. For the fifth, opening and keeping open the Cooum Bar: the following is what is the Board's intention to have prepared, but would be glad to have your opinions, or suggestions on the

several points: series of levels and soundings from the Government Bridge to the outer surf will be requisite, shewing the high and low water line at neap and spring tides.

2. A memo. giving the directions and average force of current along the coast during each month in the year.

3. A memo. of the action and effect of the surf on the Beach.

A memo. of any facts as to the shifting of the sand between the Beach and the outer surf.

What extent of Beach, would a Break-water 1000 yards long protect from the violence of the surf, and at what distance from the shore would that Break-water have to be placed?

I am directed to state that as in the opinion of the Board this latter plan will be the most effectual remedy; they propose after collecting all the information in their power to lay the whole before Government with a suggestion that the plan and question of keeping open the Bar of the Cooum River be forwarded to the Court of Directors to be submitted to some of the eminent Engineers in England who have recently examined and reported on the tidal harbours of Great Britain.

In conclusion, I am directed by the Military Board to state, that if you will aid them by contributing information on each or any of the points above adverted to, or on any others that it may be in your power to do, connected with the important subject under consideration; they will be most gratefully received and acknowledged, the object in addressing you being to solicit your assistance in furnishing the Board with information to enable them to submit propositions to, and prepare plans and estimates for Government, in order to carry out their orders as expressed in the Minute of Consultation above quoted.

The Chief Engineer has been requested to favor the Board with his observations on this important question.

I have the honor to be, Sir,
Your obedient Servant,
(Signed) A. H. Hope,
Acting Secretary.

Military Board Office,
Fort Saint George,
29th April 1851.

Inspector General's Office.

To the President and Members of the

Board of Revenue,

Fort Saint George.

Gentlemen,

1. The subject of establishing a Canal of communication from Doogoorauzpatam to connect the inland navigation, between the back-water at that place and Clive's Canal, which was referred to in your Secretary's letter of the 28th of June 1819, did not fail to occupy my attention immediately; but the absence of an Engineer in that Division for some time, and the necessity of surveying the country for want of Maps of it in this Office, as well as the nature of the subject, and other concommitant circumstances; have delayed my report to a later period than I could have wished.

2. It may be necessary to premise, that the formation of Clive's Canal, which was excavated about 20 years ago, was in point of fact, merely the regulating of the bed of what was usually termed, the North River, from the Ennore back-waters to the Cooum near St. Mary's Burying Ground at this place; which, before that time, spread itself over an expanse of waste lands, without having a determined and defined bed of sufficient depth for the purposes of communication with Boats; and as the Bar at Chepauk was seldom open, the waters chiefly from the Cortilane, so long as they continued to flow discharged themselves more generally through the Ennore Bar;—The operation therefore of digging this Canal was comparatively easy which the whole length was only about 15,000 yards; and as the lands, it is cut through, are a few feet above the level of the sea, there is generally a sufficient current during the annual Monsoons to keep the Channel clear, to the depth required.

3. The present object is to make a similar Channel from the Oopootane or back-waters at Doogoorauzpatam, along the shore of the Pulicat Lake, unto that part of it which is naturally deep enough; and which communicates with the Ennore waters;—the extent of this cut would be 22 miles;

4. The proposition was, that the Channel should be formed in the bed of the lake itself, an operation which at first sight, might appear easy of performance, but which it is feared would not prove so:—Major Cleghorn to whom the subject was referred, is fearful, that even if it were accomplished, the soil is of that permeable and inconsistent nature, that no embankments made of it would stand the influx and reflux of the waters during the Monsoon, and that the communication throughout would soon be cut off and destroyed—with this impression on his mind, he had recourse to the skirts of the lake on the sea shore side for a more favorable site, and has shown the probable expense of the work on that line of direction.

5. From the North extremity, nearly opposite Doogoorauzpatam, to *Coopum* however, a distance of 5 miles, the shore is equally unfavorable, being a bed of shifting sands occasionally broken over by the sea, and greatly exposed to torrents from the interior:—so that it is probable, that in this part (about 5 miles) the bed itself of the back-water would still, under every consideration, be preferable.—To the Vaupasawry Nullah it is Paddy land; but that tract also is liable to inundation; it is only 2 feet above the bed of the lake and being full of springs it would require much bailing out, during the excavation.

6. The Vaupasawry Nullah is a natural outlet from the lake into the sea, the Bar of which is regulated by the inhabitants to preserve their cultivation, and it is generally open from October till January:—Here Major Cleghorn apprehends, that at this season, the navigation might be interrupted, means however might easily be devised to overcome this difficulty.

7. From this Nullah to Ammun Covil where the Lake becomes sufficiently deep, about 12 miles; the site is much more favorable, and the soil more tenacious. In the first part of this line, the country is covered with jungle, but open immedately along the borders of the Lake;—a long tract of Paddy fields then succeeds, and a thick wood again intervenes. Immediately near Ammun Covil, is a small Bay or indent from the Lake round which the excavation of the new Nullah must be carried to terminate in deep water.

8. Major Cleghorn entertains, on a review of the whole sub-

ject, but [illegible] essful issue. The estimate for this work may be thus stated; assuming the mean dimensions of Clive's Canal, namely 20 yards by 4.

Length Yards	Breadth Yards	Depth Yards	Cubic Yards		per Cubic Yard price.	Rupees.
38,720	20	4	3,097,600	Excavation at the average rate for the whole depth	1[illegible]	1,54,275
Small Bridges of communication, Channels, &c. estimated at.............						11,295
					Total Rupees	1,65,570

9. It is probable however that so large a scale as has been assumed, would not be necessary, and that upon the whole 140, or 150,000 Rupees would cover the whole expense.

10. The difficulties pointed out by Major Cleghorn in the first 5 miles of the extent of this work, owing to the narrowness of the sands between the lake and the sea, and their unfavorable nature, must still be kept in mind:—On this part of the subject, I should be of opinion that under existing circumstances, it would be better to excavate in the bed of the bad water; watching favorable opportunities during the hot season, and at times of low water at spring tides, to make partial embarkments, so as to keep the work free, by the common means of the country:—In this manner, the main part of this excavation might be accomplished, and by means of *drags* the bed of the Canal might be evened and completed. In that case, no banks on each side of the excavation should be thrown up as they would immediately be washed back into it, by the action of the waters in the Lake; it would therefore be necessary to carry away the soil clear of it, and to give the sides of the excavation a great deal of slope. This would of course involve considerable expense, but as the depth to be dug would probably not be more than 3 or 4 feet the whole work would doubtless be effected at the rate above given.

11. Your Board will perceive however that the outlay is still considerable and I have not before me, any information from which I could positively state how far the advantages to be derived from the work would warrant the undertaking; but from a general view of the subject, it apperrs to me that there can be no doubt of its being *ultimately* of great benefit to the country at large, and to the population of *this place* in particular as well as to the Government.

12. If a more extended range of the subject be taken, this communication becomes exceedingly important. There are two objects immediately connected with it, which I will take the present opportunity of bringing to the notice of your Board.

1st. That which arises from its immediate vicinity to the Armegon Shoal—and 2dly. As leading to a general inland navigation to the northward of Madras.

13. The frequent occurrence of Ships striking on this Shoal of late years, has called the attention of Government to its position, nature and extent. In consequence of which, a minute survey of it was taken lately by Captain Maxfield of the Nearchus, the result of which seems to open to view the possibility of the space between the shore and the shoal becoming ultimately the wintering harbour, for the coasting vessels belonging to, and frequenting this Port. Captain Maxfield has himself, as I understand expressed this opinion, and thinks that it is a subject well worthy of further enquiry. Through the medium of a friend, I obtained a copy of this survey, and have now connected it with the plan which I have the honor to submit, exhibiting the line of direction proposed for the Canal in question;—and your Board will readily perceive, that if such a plan could be brought to maturity the communication with Doogoorauzpatam would become of much greater importance.

14. I am the more desirous of submitting this subject to your Board, as in case you were pleased to lay it before Government, advantage might be taken of Captain Maxfield's next arrival at this place, to prosecute the enquiry; meanwhile I have corresponded with the Collector on this subject, and his report seems generally to uphold the idea entertained of the feasibility of such a project. He states, from the information of the Pilots and Boatmen of that country,

"That the surf on the shore between Doogoorauzpatam and the Bar of the Vaupasawry Channel to the North of Poody Point, is not by any means so high as on the other parts of the Coast, and admits of much more easy landing, in consequence of the vicinity of the Armegon Shoal.

"2. Vessels could lay conveniently at Anchor during the Monsoon, within the said Shoal, the water generally remaining

smooth, excepting during storms, but in the latter event, it would not be practicable for them to put to sea, on account of the extent of nearly 10 miles, by which the said fronts the Coast.

"3. The anchoring ground within the Shoal is firm and good, nor is there any danger to be apprehended from the currents."

15. It is therefore reasonable to anticipate some advantage to be ultimately derived from this Shoal by converting some part of it at least, to the shelter of the trading vessels in the Monsoon season, at the same time affording the means of removing the present danger to which the shipping is exposed, by the erection of appropriate *beacons* and the Pulicat Lake would then become a general rendezvous both from land and sea, immediately connected with this Presidency.

16. I have long had these improvements in mind, but had not yet been able to suggest them except so far as to recommend, through the Board of Trade, a few years ago the expediency of erecting *beacons* at least, on the points of this Shoal, if the construction of a Light House should be deemed too expensive.

17. I shall not prosecute this subject farther at present until I am honored with the orders of Government upon it, and shall only add, that all the information I have been able to collect regarding it, seems to encourage the idea; and I am sanguine in my expectations, that the day may not be far distant, when the suggestions which I had the honor to make to Government, as Acting Chief Engineer in 1818, of an inland harbour within the Chepauk Bar, being connected with the present object; will establish a convenient and profitable inland navigation from that Bar to Doogoorauzpatam, upon a line of 67 miles; connecting several minor branches which may afterwards be made to fall into it from the interior districts.

18. The observations which I have made on this subject, since it has occupied my mind, leaves no doubt in it of the project being successful if it be undertaken upon mature and well digested plans, which, prepared on principles of reasonable economy, would I conceive come within a compass that would render the measure advisable.

19. As connected with a general *inland* navigation, my first

object would be to bring a Canal down from Cuddapah to Doogoorauzpatam, through the Nellore District, to facilitate the conveyance of the produce of those countries to this place: from Cuddapah, it might then be extended, and made to branch out to the different parts of the Ceded Districts; and it is not improbable that another communication from the neighbourhood of Cummun and Canool might likewise be opened into it.

20. The whole of this plan your Board will perceive will require much consideration and attention, and it might possibly be advisable to delay the execution of this Canal until a more detailed report can be submitted for the consideration of your Board and of Government; it will occupy some time, and therefore I have thought it necessary to give you this my general view of it in the first instance, lest I should be employing the services of the department on an object which might not ultimately meet the wishes of Government. It would also be necessary for me to know, how far the territory of the Dutch settlement at Pulicat extends, lest it should interfere with the line proposed.

21. I shall take the liberty at this time, to call the attention of your Board to the consideration of other works of this nature, that in my mind would mainly tend to the prosperity of this part of India, and of the Honorable Company's Government.

22. The mode of irrigation used in this country is peculiarly well calculated to facilitate the establishment of Canals of communication; which otherwise, where there are no large Rivers, or that they are for a long time dry, or nearly so, in the course of the year, would scarcely be practicable except immediately along the Coast:—but by enlarging the principal reservoirs, and mak[illegible] them subservient to the proposed navigation, a considerabl[illegible] tion of water which is now lost or wasted, would easily be [illegible] ed and converted to useful purposes; and while the Ca[illegible] thus be supplied the means of irrigation would at th[illegible] be improved; and the cost of labour, generally s[illegible] so moderate in this country, that the first expen[illegible] be very small, compared with that which si[illegible] involve in other countries; while the climat[illegible] to this region would favour the progress [illegible] cute which, the population of the c[illegible]

sufficient under proper management; and the light convenien basket-boats of the country, would be well fitted for the dail traffic, and suited to the frugal habits of the people;—a circum stance which would supercede the necessity of steam or othe expensive boats, and at the same time would require but a com paratively small draught of water.

23. Leaving the Northern Provinces and turning my views to the S. W., the first line of communication which presents itself, is across the Peninsula from *Pyniany* on the *Western* Coast, to Trichinopoly; and thence down the Colleroon in the first instance to Devicotta and Porto Novo. The second line of communication would be through the Bahramaul and Salem countries, taking its rise from the Cauvery at the N. W. boundaries of those Districts, proceeding down the Amboor valley, to the Paular; to communicate afterwards, through the Cauverypauk Lake and Golden Channel, to the Ennore back-water. Other branches might afterwards be connected with these main tracts, and some even from the interior of Mysore. Another line might then be taken from Trichinopoly to the Presidency, passing to the *Westward* of Pondicherry, in connection with the back-waters of Alumparva along the Coast.

24. Resuming the first line mentioned, across the Peninsula, the navigation might then be extended through the Cochin water to Quilon at least; and Northward to Cannanore, or even beyond that station; in this manner the greatest advantage would be taken of the *break* in the Ghauts, betwen the Annay Mullay Mountains, and the Neilgherry Hills; the only interruption in their range to the Southward of the Taptee's valley, in the Deckan.

25. This will be sufficient to convey to your Board the gene- view I have taken of the subject, which however will require time to mature and particularize; but the works might be ted progressively, after the general outline had been taken ined upon; and I apprehend that the inland navigahe Coasts both East and West, might very early be on.

I have the honor to be, Gentlemen,

Your most obedient Servant,

(Signed) J. T. W. DeHavilland, Major,

Inspector General of Civil Estimates.

2.

To the Secretary to the Board of Revenue
in the Department of Public Works

Sir,

1. In conformity to the instructions of Government conveyed in the Extract from the Minutes of Consultation under date 20th November last, I have the honor to report, that in reference to the suggestion contained in the 2d para of the report of the Committee alluded to, and the Correspondence which was submitted for my perusal, I have made a survey of the Ennore Bar and Pulicat Lake, and observations upon the levels and the rise and fall of the tides there and at Madras, and I have now the honor to state the results of my examination of the project to which my attention has been directed.

2. The proposition referred to in the Correspondence above mentioned has three important objects.

1st. The maintaining of a constant communication between the Cooum River and the Sea by preventing the formation of the Bar and the closure of the mouth of the River.

2d. The improvement of the navigation of the Cochrane and Katapully Canals and the Pulicat Lake, extending in a northerly direction as far as Soloorpett, distant 50 miles from Madras, and

3d. By the attainment of some additional facility in the drainage of Black Town, by the preservation of a Channel free from deposit at the lowest practicable level.

3. In the report of the Committee above referred to, the possibility is stated of all these advantages being obtained by "closing "the mouth of the Ennore River by an embankment with a Calingulah of a height so regulated as to obviate the danger of "floods, and this turning into the Cooum River, the whole of the "accumulated waters which are now annually collected in the "Pulicat Lake." It was expected that the head of water thus obtained would be sufficient to keep open the mouth of the Cooum River during the whole year, in the same manner as it is now maintained free during the freshes in that River, but the correctness of this supposition depending entirely upon the amount of the accumulation upon which the whole scheme depends, and upon various local circumstances which might limit the extent to which

it could be applied, it was added that "a detailed report upon the "various points relative to this subject would require a command "of information to be obtained only by a special survey of the "localities," but that "the project was well deserving the attentive consideration of Government." Under these circumstances my attention has been directed to the subject, and in addition to a careful inspection of the whole of the localities, the following reports bearing upon the subject have also been studied.

1st. Colonel DeHavilland's report upon the Pulicat Lake and Canals—2d. Lieut. Underwood's and Captain Cowle's report upon a survey of Blackwood's harbour—3d. Mr. Cotton's report on the Pulicat Lake and the Cochrane and Katapully Canals—4th. Mr. Ross' report upon the Ramperiod River—5th. The report of the Committee before alluded to—6th. Colonel Monteith's observations upon that report.

4. The results of the above examination and a careful consideration of the circumstances have however failed to confirm the expectations which were held out in the report of the Committee, the facts which were elicited by my enquiries and observations, not only tending to discourage the hopes entertained in regard to this project, but being of such unfavourable character as in my opinion to preclude all reasonable chance of success.

5. My reasons for this opinion are the following—first, in regard to the principal object of the undertaking, viz. the maintenance of an uninterrupted Channel at the mouth of the Cooum, difficulties have presented themselves upon a careful examination of the subjects which were not anticipated when the scheme was first considered; the chief of these are that first the Pulicat Lake itself being merely confined by a long and narrow strip of sand, has little strength to resist an accumulation of water should it be cut off from all other mode of discharge than that provided by a Channel of the great length and comparatively small section of the Cochrane and Katapully Canals, so that were the Calingulah established at its mouth, and were it to remain firm there could be no security against the waters forcing for themselves other passages and thus the whole plan being frustrated—secondly, supposing this difficulty to be obviated another great objection would arise from the vast expense of the works to be executed. It will

ently be seen that to secure the smallest prospect of success, antage must necessarily be taken of the utmost rise of the ers in the Pulicat Lake, which must therefore be penned up to level of the highest accumulation known there. This may be imed at about 5 feet above the mean level of the Sea; now mean level of the whole of the intervening country cannot be posed, on an average to stand higher than from 2 to 3 feet, the cipal part of Madras itself being very little more than the lat- elevation; should any attempt be made therefore to pen up waters to so great a height above their natural level, it would ndispensable in addition to Calingulahs across the mouth (or it) of the Cortelaur River, the Pulicat River, and Vapasawry Doogoorauzpatam Channels to embank the whole of the inter- ng line of communication as far as Madras itself, or submit to nundation of the whole of the vast track of land bordering the t in this neighbourhood. Not to dwell upon the extravagant of a double embankment of more than 30 miles in extent, hich must be added the extension of similar works along the nnels on either side of every River and every water course in- ected by them, it may be sufficient to point out that even the truction of an Anicut across the Cortelaur River of a permanent acter would alone be a work of great difficulty and very serious y. The case is here very different from that of the construc- of a dam across a River whose bed is dry during many ths in the year, and materials are at hand. In the most favor- position for an Anicut across the principal Channel of the Cor- ur, the depth is not only very considerable but it is permanent, the nearest point from which materials could be procurable ld be from the Red Hills. The same difficulties apply in a ater degree to the construction of any permanent work across Pulicat River and the other Channels which now exist, and would r themselves for the escape of the waters when so much elevated ve their present height. Nor is it possible at present to form approximate computation of the extent of the work to be per- ned, the number and size of the apertures to be closed being discoverable by an inspection of the locality at the period of umulation except by a series of processes of the most tedious cription. Enough has however been said in this place to shew t the works connected with this project are of the most formida-

ble magnitude, and would most probably involve an enormous
It will be unnecessary, in connection with what follows to e
into more minute details on this part of the subject. Thirdly, (
the supposition that even the united force of the above object
were overcome, that the work was established in the most subs
tial and effective manner, and the head of water were securely r
tained at the height above mentioned, it has now to be consid
what degree of assurance would thereby be obtained of the cer
ty of the benefits aimed at. And here with regard to the ope
of the Bar of the Cooum River it must be observed, that althoug
effectual passage is now maintained annually after the arti
opening of the Channel by means of the accumulation of waters
up in the back-water and bed of the River Cooum during the fre
and which seldom exceed the height of 5 feet here supposed,
that it by no means follows that an accumulation however
having only the same relative superiority of level would hav
equal effect when separated from it by a distance as great as
which intervenes between the nearest portion of the Pulicat
and the proposed entrance, and which amounts to not less
30 miles; so small a difference of level in so great a length
cates a slope too minute to give rise to the required velocit
the current necessary to clear its mouth of deposits, even
there no resistance; and altogether inadequate to contend
the intrusive effect of the surf, when brought in opposition t
violence of that powerful and unwearied element.

6. These observations apply more particularly to a consi
tion of the scheme in reference to the special conditions of the
ject which were contemplated by the Committee, who interp
the instructions of the Government to refer to the maintenan
an open Channel at the Bar, of a size bearing some compa
with that which is usually observed there during the out-fall o
freshes, because it requires to be observed that the velocity o
issuing current and its efficiency in keeping open a clear pa
must depend essentially upon a comparison of its section
the minimum area of section of the Canal forming its junction
the reservoir of supply, and this has been supposed in the
going observations to be limited to a size not exceeding the
tional area of the smallest part of the Cochrane's Canal, a di
sion which is probably much less than what was in view whe

…t of the Committee was called for, but which if enlarged …t be calculated to lead to still less favorable results.

It seems probable then, that a difference of level of only 5 … when distributed along a Canal of communication of 30 miles …ngth, would be totally inadequate to create a current powerful …gh to scour its bed and keep it free from deposits even with… …eference to any opposing agency, and that there is no likeli… …l whatever of its being able to preserve its mouth free from …ccumulations continually forced in by the beating of the surf.

If however the maintenance of some Channel, however …l, should be thought an object of sufficient importance to … the large outlay before pointed out, there can be no doubt …y contracting the area of the proposed opening in a suf… …ee, so as to reduce it to a small proportion of the sec… …f the connecting Canal, the strength of the issuing current …t be so much increased as to enable it to overcome the resist… …of the opposing waves: an effect which would be still fur… …promoted, and even a larger opening secured, were this lat… …ifficulty overcome by the construction of a Break-water. …the measures here referred to embrace the accomplish… … of such extensive and costly works for the production …ut a partial benefit, that it cannot be necessary for …ere to enter into more details as to their prosecution in the … referred to, more especially as the success of the scheme even … so modified, would be further dependent upon the consider… …s which follow—Fourthly. It has been above shown that …osing the embankments to be made, and the accumulated …r to be secured, at the required level, still that the current …d be too languid to be effectual in keeping open a free com… …ication with the Sea, unless means were taken to limit th… …ure of discharge to a comparatively very small size, or its …th were defended by a Break-water, or both these measures …resorted to. But extravagant as the necessary undertakings …d seem to be to effect so limited an object, it has been stated …by a due calculation of the measures adopted, there would be …ason to doubt of success being obtained to the extent referred …nd as regards the circumstances under consideration, that is, …ng as the head or difference of level before referred to con… …[illegible]: but it must now be observed that whatever diffi…

culties present themselves to the first maintenance of a free c munication, with the full head of water, these acquire a prog sively accumulating force in proportion as to the actuating po by which they were at first subdued, becomes gradually dimin ed in energy; hence that a Channel which might be with diffi ty maintained by the current kept up from a reservoir elevate feet, would be inevitably choked when the difference of level reduced to 2 or 3 only. The observations which have been m therefore regarding the necessity of a very considerable reductio the size of the Channel and the defence by a Break-water, ap with two fold force when referred to a consideration of the pro ble results after a sensible diminution of the accumulated wa has been made, either by the discharge itself or by the long continued evaporation during the hot months, or causes combined, whereby it is not improbable that th of elevation would be reduced by at least one half. It may th fore be finally stated that should the objects here referred t nsidered of sufficient importance to reconcile the great expe re necessary for erecting Calingulahs across the Cortelaur ulicat Rivers and the Vasareddy and Doogoorauzpatam Bars so securing the eastern border of the Pulicat Lake, where ne ry to the height of 5 feet by embankment, to embank also tire length of the Cochrane and Katapully Canals and the laur and Cooum Rivers so far as to secure them to that level rther to cut fresh Channels for the minor water courses and e drainage of the low lands embraced by these Canals and vers just referred to. If also an artificial mouth of a duly rtioned size protected by a Break-water be constructed—(un kings, the mere idea of the cost of which all but stamps the sch th impracticability) there is little doubt that a narrow Cha ght be effectually maintained through which a free commun tion would continue as long as the works upon which it woul dependent were kept in efficiency, but which latter after b erected at the great sacrifice of expense here adverted to, woul liable to the objections pointed out in Colonel Monteith's re pon this project, in whose general remarks upon it I fully con

9. It may be proper here to mention, that the circumstance the Ennore Bar and the fact of its being kept open every year some months by the freshes of the Cortelaur River

of the accumulated waters in the Pulicat Lake, do not bear a strict comparison with what might be expected to ensue were the opening for the discharge of the waters transferred, as it were, from Ennore to Madras. The Katapully branch of the Canal being a very much larger and more capacious duct than that afforded by the 10 miles forming the southern extremity and the violence of the surf also at Ennore being much less formidable. The former circumstance, added to the Katapully Canal being only ⅔rds of the length which the combined Channel would measure, contributes to the production of a much larger and more powerful stream than could possibly be anticipated under the conditions of the project, while the latter circumstance denotes the absence of the chief obstacle to its success. It seems indeed upon considering the situation of the mouth of the Cortelaur river and the Ennore Bar with the surrounding localities, to be not improbable that its remaining open usually for weeks, and occasionally (during mild seasons) for some months after the first discharge of the freshes, may be attributed in chief to the protection which the mouth derives during the prevalence of the Monsoon and a northerly swell from the adjoining shoal, which acts the part of a Break-water in defending it from the beat of the Sea, and the facts that it is not until after the change in the Monsoon, that the Bar is shut up by the in-draught of the tides, and further that the more northerly Bar at Pulicat which lies completely secured by the shoal is frequently open all the year round, and occasionally for years together, seem to strengthen this opinion. The circumstances, therefore, of the proposed scheme for keeping open the Bar of the River Cooum and the actual condition of the Ennore Bar during and after the occurrence of a fresh, and during the discharge of the waters of the Pulicat Lake, cannot be compared together, unless 1st, the supply and velocity of the issuing current were made equal in the two cases—and 2d, unless the mouth of the former were protected to the same extent that the latter is by the Pulicat shoal during the northerly Monsoon. Moreover even with these superior advantages the Ennore Bar is liable to shift and invariably clo[illegible] th[illegible] that the favorable causes essential to its co[illegible].

10. The other features in the [illegible] g the drainage of Black Town, and [illegible] vi-

junction of the Cochrane and Katapully Canals and the Lake as far as Soloorpett.

Were the project fully established in the manner pointed out, considerable benefit would be derived in regard to the former purpose, because all the drains lying near the main level of the Sea, that is the principal sewers might be frequently scoured out by water let in from the Canal, but the chief part of the drains being situated much above that level could not be affected by it, and must be scoured out by other means.

11. With respect to the navigation also there can be no doubt whatever that the addition of 4 or 5 feet to the entire area of the Lake, and the upper part of the Canals would have a most beneficial effect,and that the facility of transport wouldbe much increased, but the same effect would be as certainly and more securely attained by deepening these Canals to the same depth, or to whatever extent might be found necessary, and by cutting Channels in the shallower parts of the Lake to the desired points of communication the expense of which operation, would be trifling compared with the cost of establishing the project under discussion. This subject has been ably and fully investigated by Colonel DeHavilland, by whom an accurate survey of the Lake and the surrounding lands was prepared, of which I have herewith the honor to forward a Copy, both for the assistance which it will afford in forming a correct judgment of the various localities referred to in this report, as well as because it exhibits the tract of the most favorable line for a work of the character just mentioned, and in referring to his letters for further details upon the subject, I shall merely add, that the question has been subsequently taken up by Mr Cotton, who in a report submitted to Government, on the subject of the Lake, has entered into the discussion of the improvment of the navigation with a fulness and ability which leave nothing to be desired.

12. The fact of the Pulicat Bar continuing open for so long a period under the p[illegible] of the shoal ; the parallel case also of the Ennore Bar [illegible] of the Northerly Monsoon and the [illegible]s having a free communication w[illegible] the Coast where the action of th[illegible] at Madras, lend force to the

the Cooum are less stagnant. The whole of these works should be of the most substantial construction, but whether the returns from the Canal together with the contemplated improvements on the Cooum, are such as to warrant a large outlay, is not for me to decide; in fact it remains an open question whether as regards the latter they should be local and direct, or dependent on works higher up, offering advantages both for irrigation, as well as occasionally, throwing a body of water into the River to prevent stagnation.

9. As far as I am acquainted with the country westward of Madras, it appears to me to be very possible to divert the waters of the Paular from near Arcot down to the Cooum. The Cauverypauk Tank is now filled by a cut from the former River, and to connect the various Tanks below it with the escape Channel of the Tank, seems to me to require but a comparatively small outlay and but little skill, several of these Tanks with their escape Channels from the Calingulahs lie almost in a line with the Cooum near Poonamallee. A chain of Tanks to the Chumbrumbaukum Tank therefore, as will be seen by a reference to a Map, could always be filled even in less than an ordinary Monsoon with due regard to the levels which are favorable, the descent being about 6 feet in a mile. Officers acquainted with the country will doubtless be able to afford more satisfactory information on this, and other points bearing on the subject under discussion.

10. The action of the surf on the beach is perhaps a subject that I may be able to offer some information on, as my duties often take me out when gales are at their highest, and I have witnessed the effects which are to be described, and I believe I have observed them correctly.

11. It may be as well to point out the cause of the surf strictly so called, as distinguished from mere breakers, as the retaining an open Bar depends I believe in some measure on its prevention. On a steep shore the action of the waves is different from that on a beach, the declivity of which is small, in the one case it is a destructive, in the other, it is an accumulative action as regards the effect on the shore; at a certain definite limit between these two inclinations, both these actions recur, the detrital matter washed down by a receding wave being in part or wholly returned

by that following; where the opposing forces are equal a deposit will take place, and form a bank; the accumulation of water over this bank by the oscillations of the Sea, give rise to the "surf," so long therefore as the inclination from the shore is not changed, the destructive and accumulative action thus neutralized, tends to preserve the land from further degradation.

12. The surf bank is formed in about 14 feet water at about 450 feet from the shore, the soundings being 14 feet at the foot with an inclination of 45, and about 9 feet over the top, which is nearly level; there is then a gradual ascent to the limits of high water. When this bank is disturbed by the agitation of the water extending down to it, its removal is a natural result, and is more or less rapid according to circumstances; the surf has then no longer any existence, the waves being the ordinary breakers of an open Sea, or roadstead. I think it may be taken as a general rule that the limit of the outer "surf" is about 450 feet from the shore, but the distance at which it breaks is dependent on the force of the wind and current.

13. During heavy gales of wind these breakers infringe on the shore with irresistible force, though I have seen none apparently of greater magnitude than the high surf wave about 9 or 10 feet,—but they roll in with more destructive violence and the beach rapidly disappears under their action. In the last gale of May 6th which was neither violent nor of long duration, there was not above 40 feet of clear beach from Capper's House to the Cooum Bar, with the exception of a small portion near the Ice house (where the three vessels were wrecked) and beyond the Bar, probably owing to the deflection of the water by the Bar groin, there was a considerable [illegible]oachment on the land not far from the saluting battery; more so than I have ever witnessed. The whole of the groins also were "turned," but such is usually the case during even trifling gales, or bad weather, they are therefore inadequate as a permanent protection to the beach, unless other remedial measures are adopted in connection with them, to preserve any accumulation that may form from being washed back into the Sea. There appears to be no necessity for forming them of such permanency as those recently thrown upon the South beach. It appears to me that the beach can only be re-

claimed by a succession of works seaward and these should be of comparatively cheap and easy construction as costly works on contingencies are ever a bar to improvements and often fail for want of due deliberation.

14. As regards the plan suggested by the Board for erecting a protective Break-water, and rendering the Cooum a tidal River, any remarks I may offer, I beg may be considered as merely suggestive. The retaining an open tide way in the River will depend on two circumstances—1st, the tendency of the waves to form the surf bank, must be controlled—2d, the tide must have sufficient velocity to scour the Bar.

15. We can form no conclusion on either of these points at present when the bar is open as the tendency to form the bank is still in operation.

16. With respect to the first. If the view I take of the subject be correct, the formation of the surf may be controlled perhaps effectually by directing the current immediately over the "outer surf" line by means of two low groins extending towards, and nearly up to it, or about 350 feet from the shore, a Break-water embracing the whole front or more, being constructed about 100 yards in advance leaving this distance open sea-way for the water to flow through. The general direction of the current is North East and South East or thereabouts, but meeting the shore it is deflected and glides along the coast, the groins therefore should I think be of a curvilinear form, the sides meeting at an angle with smooth masonry facings. Should there be any probability of a silting up in rear of the Break-water, openings must be left in the work below at intervals, to admit of a free passage of the water—without soundings or a sketch of the beach, and more detailed information connected with the subject, it is impossible to form even a guess as to the proper distance at which the Break-water should be erected from the shore, and the frontage which it should cover. The limits of these works however I imagine, will be defined by the outer surf line, the direction and force of the current, and the distance at which the freshes run out to Sea, in order that as little suspended matter as possible may fall in the still water in rear of the Break-water.

17. In reference to the second point that the ebb tide must have sufficient velocity to scour the entrance into the River it may be as well first to state that the Bar is formed by the accumulative action of the waves, and that with a full River difficulty has been experienced in keeping it open by manual labor. The rise of the tide is from 1′ 9″ at the quarter to 2′ 10″ at full moon as determined by the late Mr. Taylor, but these observations extended over but a limited period.

The difference between the lowest and highest tide in the course of the year will be found I think to be from 4 to 5 feet. Assuming 3 feet as the average rise; what will be the velocity due to this height on the ebb of the tide and will it be sufficient to scour the Bar and to what distance will the tidal influence extend up the River? What will be the difference between the times of ebb and flood, and will the former predominate? The solution of these questions depends on circumstances of which I can only form a limited idea. The waters pent up in the bifurcation of the River will probably be equivalent to a reservoir, the discharge from which will be accelerated on the ebb, there may be thus a velocity of the current greater than that due to the rise of the tide. During heavy gales at spring tides the influx of water would be far greater than in ordinary tides, and might have an injurious effect on the bed, and perhaps endanger the safety of the Bridges. It seems very desirable that a series of observations should be undertaken to determine the velocity of the River during the freshes, the height and flow of the tide, &c. so as to enable the authorities to decide on the best measures to be adopted for carrying out the views of the Board. As far as I am aware of the flow of the tide I believe it scarcely ever extends beyond the College Bridge.

18. The suggestions now made have been written as they occurred to me, but in the absence of data to test their validity or claim to consideration, I can scarcely hope that they will prove of any value, having so far however, discussed the several subjects embraced in your letter, I venture to add what appears to me most deserving of consideration.

19. Instead of attempting any extensive works immediately in connexion with Cooum River, I would direct attention to the Ennore Bar and Cochrane's Canal, with the view to obtain suffi-

cient water by an open Bar and Lock, to permit a free communication at all times with Madras, as well as to flush the Cooum as frequently as water could be let off, without detriment to the navigation.

20. The expense of any works in this direction would not I conceive far exceed those contemplated for the Cooum, and would in part or wholly be repaid by the traffic, which would probably be increased, but the Collector of Madras would no doubt be able to afford information on this subject.

21. In para. 6 I have offered a suggestion relative to erecting a Bridge with sluice gates, near Messrs. Ashton's shop, the former has long been contemplated, the addition of sluice gates would be so far advantageous, that a considerable body of water could be retained in this part of the River, and perhaps be productive of benefit as a sanitary measure. Could not tolls be levied on a Bridge of this kind with every appearance of justice.

22. I am doubtful from the small rise of the tide generally whether the scouring effect of the ebb would be such as to preserve a clear Bar, whatever may be the nature of the works in front, but I feel pretty confident, that during heavy gales and at spring tide, that the flow of water would be very considerable, and it would be necessary to guard against any injurious tendency, to lay substantial floorings under the Government Bridge and perhaps to one or two above it, these would be expensive.

23. It is probable however, that any plan for improving the irrigation of the district in the direction of the Cooum, the improvement to the River being subsidiary and final, will be found more worthy of consideration, than any proposition for a mere local benefit, and which at best is but of doubtful issue and importance.

I have the honor to be, Sir,

Your most obedient Servant,

W. K. Worster, Captain,

Madras, 17*th June* 1851. *Artillery.*

No. 726.

From Captain E. Lawford,

Civil Engineer, 6th Division.

To Captain A. H. Hope,

Acting Secretary Military Board.

Sir,

I have the honor to acknowledge the receipt of your letter of the 28th ultimo, requesting to be informed whether I propose to offer any suggestions relative to the improvement of the Cooum River at Madras, called for in your letter of the 29th April 1851.

2. My attention has been so engrossed by my immediate duties, during the last six months, and my knowledge of the state of the Cooum is so very limited, that I have been prevented from responding to the Board's requisition hitherto, and in venturing now to lay before them a few remaks, I must beg to be understood as recording the results of my observations on Rivers in this Division, leaving to more competent judges to decide on their applicability to the circumstances which have led to the present enquiry.

3. The objects sought in the improvement of the Cooum are the deepening of its Channel, and the opening of the Bar at its mouth, and as both of these have to a certain extent been effected by the alterations of the Cuddaveyaur at Negapatam, a brief notice of the works on that River may be acceptable, and is therefore extracted from a recent report.

"My attention was first called by Sir Henry Montgomery then Collector of Tanjore to the difficulties of the Port, owing chiefly to the change which had taken place in the River Cuddaveyaur, by which the main stream was discharged into the Vellayaur at Velangunny, and the advantage of the land floods was lost to Negapatam. To remedy this a straight course four miles long was cut across the swamp, and the Cuddaveyaur was turned into it and embanked. The Vauleyaur a small stream was also straightened and partly embanked. The effect of these operations was to bring a much greater body of fresh water to the Negapatam Bar, and

in consequence to maintain deeper and more concentrated Channel and tidal basin. Further the results have been most beneficial on the drainage of the country influenced by these Rivers.

"But it was necessary in combination with the above improvements to attempt something for fixing the outlet to the Sea, and restraining as far as possible that tendency of the river to wander northward, which is apparently caused by the wind and current so long prevailing from the south."

"It could not be expected that Government would sanction the heavy expense of constructing a perfect pier or jetty, and therefore a plan was adopted by which blocks of the old masonry of the Fort were built on wooden platforms, and allowed gradually to settle down, after which a superstructure of the same material was raised on these foundations. This jetty serves as an embankment to the northern side of the mouth of the River. It has suffered frequent damage but is now tolerably substantial, resisting the action of the Sea which in the Monsoon breaks on it, as well as the deepening effect of the River current which sweeps along it. The pier head is within the line of high water in the fine season, but beyond it during the Monsoon, and is protected by a solid mass of brick masonry which was built in a box of 6 feet cube, resting merely on the sand. This has stood remarkably well, and affords a very effectual defence to the jetty. The shifting of the Bar is not wholly prevented, although restrained within very much narrower limits than formerly, and the outlet is permanently fixed within a very convenient distance of the Custom House opposite to which a landing place is formed."

4. There can be no doubt that these works have answered their purposes as far as they have been carried. The lands are drained, the River is deepened and the Bar is much more open than formerly, but the Board will observe that I do not by any means consider that the improvements of the Port are sufficient.

5. The Vellaur which falls into the Sea at Porto Novo has within the last twenty years been improved by extensive cuts across two large bends a few miles above its mouth, but though the country has thereby been greatly relieved during heavy floods, the Bar has not been at all deepened, the causes of which in my opinion

are that the embankments do not extend to the mouth, and that the new bed is not yet sufficiently acted on by the current.

6. The increase or rather extension of tidal action in the bed of a River can be gained only by deepening it as it approaches the Sea, and this effect will most surely be attained by embanking it as high up its course as is necessary to confine the land floods to a moderate breadth of Channel which may be safely estimated by the water-way allowed to any Bridges within that distance.

7. No fact has impressed itsel. more strongly on my mind from observation than the tendency of inundations to raise, and of embankments to deepen the bed of a River, and surely this is what theory alone ought to teach us, though the opposite opinion has been held.

8. I am aware that embanked Rivers are regarded with some apprehension, and no doubt the effects of breaches are disastrous, but the flourishing state of Tanjore and a comparison of the expense of maintaining the River dikes of that Province with the amount of Revenue which is produced by their influence will prove the advantages of such works, and shew that with due precaution the embankment of the Cooum would be attended with no material danger.

9. Recent improvements of another stream in the South of Tanjore illustrate my remarks on this point most clearly, and I can point out highly cultivated lands close to the newly raised dikes, where but a few years back all was swamp. The River now flows in a well defined bed with a steady current where formerly it lost itself in inundation, and although the tide extends farther inland than before in the bed, the salt water never overflows the lands.

10. The above relates only to the improvement of a River up to the point of discharge into the Sea, but I think that the work should not end there. It is true that the tidal influence on the Coromandel Coast is too feeble to effect much in keeping open a deep Channel, but advantage may and should be taken of such aid as it affords when the freshes themselves are few and uncertain, and to this end the confinement of the land stream should

be carried into the Sea by means of a groin or jetty, if indeed two works of that kind are not required.

11. The extent of such works should be in proportion to the strength of the surf by which the Bar is formed, and if only one jetty is constructed, it should be on the left or northern bank, because the prevailing current tends to throw the sand from the South, and the same cause prevents the free set of the flowing tide into the River when the Bar is open. I have often observed this at Negapatam, where the jetty is far too short to overcome the effect of the current in throwing the Bar to the Northward and retarding the flow of the tide.

12. I am too much a stranger to Madras to hazard any comments on local circumstances, but it has always struck me that the system of forming a temporary road across the Cooum close to its mouth must have a pernicious effect during heavy freshes, for although the sudden discharge on removal of the obstruction may deepen the bed for a short distance above, yet the previous suspension of the flood, will in the mean time have choked the upper Channel and overflowed the country.

13. Regard must of course be paid to the affluents of an embanked River, which will require similar treatment up to a certain level which can easily be ascertained.

14. Whether after all the effect producible by improvement of the Cooum itself without the aid of a supply from any neighbouring River would be of sufficient value, I am of course now unprepared to consider, but I am decidedly of opinion that no additional body of water would avail unless restricted to a bed which its volume would keep free from obstructions.

I have the honor to be, Sir,
Your most obedient Servant,
E. Lawford,
Civil Engineer, 6th Division.

Civil Engr.'s Office, 6th Divn.,
Trichinopoly District,
Veerasoorum, *2d Dec.* 1851.

No. 231.

FROM CAPTAIN COLLYER,

Civil Engineer, 4th Division,

TO THE SECRETARY TO THE MILITARY BOARD,

SIR,

Para. 1. I have the honor to acknowledge your letter No. 2,703 dated 29th April 1851.

2. The Cooum River is formed by the surplus water of the Cooum Tank, which receives a supply occasionally from the Paular, after the Govindawaudy, Parundoor, and other Tanks immediately above it are filled; during the late rains those of the 3d and 4th of May the Cooum Calingulahs were only open upon the 5th, so that much water upon that occasion did not come from the Paular.

3. At Suttey the Cooum is joined by a Channel taken off from the Cortelaur at Casaveram, near Perumbaukum—this Channel has for many years been out of use, having been filled by accumulations of several feet deep. It was however opened this year to a width of 8 yards; and brought into the Cooum a large body of water—the Cortelaur is formed of the waste water of the Cauverypauk Tank, and also drains part of Sholinghur; it having a principal feeder in the Quodekel Tank. There is great facility of increasing the water in the Cortelaur by a cut from the Poinay River at Mailpaudy; in addition to this there is the drainage of the Country, between Cauverypauk and Madras; the land drained is however of no great width, probably not exceeding 20 miles.

4. The Pulicat and Ennore back-waters are distant from Madras; and with a tide of only 3 feet rise. I doubt if any the least effect could be produced on the Bar of the Cooum through their means.

5. There is upon the Adyar about 5 miles to the North-west of St. Thomas' Mount, a large Tank in ruins called the Pumbulzairy. The lands formerly watered by this Tank together with the lands formerly in its bed, are now watered by the Chumbrumbaukum Tank—this tank might be restored and can be filled from the Cumbuncal; a Channel now in ruins, but which it is

proposed to open in connection with an Anicut across the Paular River—water from this Tank might probably be taken by a Channel from the Adyar through the Mylapoor Tank, into the Cooum River.

6. By erecting an Anicut across the Paular at Cauverypauk and another across the Cortelaur at or near Casaveram, and by erecting head sluices to all the numerous Channels taken off the Cooum between Suttey and the Female Asylum; a considerable body of water might at times be conveyed to Madras.

7. Some of these minor works, are now in contemplation or are in progress and will be erected irrespective of any advantages to the Cooum for the improvement of the irrigation, many very important Tanks being dependent on the Cooum and the Channel from the Cortelaur.

8. From the Female Asylum to the Sea, I am of opinion that head sluices should be placed to all the nullahs, or streams, or ditches, taken from the Cooum so as to confine its strength to it main Channel.

9. I anticipate a large increase of water in the Cooum River from the works contemplated; or in the course of con struction for the improvement of the irrigation; but the increase will be limited to a few months in the year. The Rivers having no great length of course and not being generally influenced by other Monsoons; it is however probable when the Paular Anicut is erected that water may be thrown into the Cooum and to the Tanks in the neighbourhood in the month of May.

10. I am of opinion from the flatness of the ground generally in the neighbourhood of Madras, that no reservoir within a reasonable limit of expenditure could be formed sufficiently extensive to scour out the Bar of the Cooum River.

11. To state exactly what the means to be adopted with reference to the Rivers above named should be; or where all the requisite works should be constructed; as demanded by the Board, requires surveys, levels, minute examination of the country and a mass of facts of which I am not possessed. I am however of opinion generally, that between the Female Asylum and the Sea, the River should be confined in its width and directed so as

to expand its force upon the Bar ; and that two groins or je
should be run out beyond the surf.

12. Much valuable information upon the currents, actio
surf, travelling of the beach, &c. will be found in the reports of
Committees appointed at various times to enquire into t
particulars.

13. The keeping the Bar of such Rivers as the Cooum per
nently open, is a matter attended with uncertainty ; nor does
perusal of the evidence, before the Commons in 1844 on the Birk
head Docks, from the extraordinarily conflicting opinions
eminent Engineers on the subject of scouring, lead me to beli
that they would throw more light on the subject than is to
procured from a local Committee.

14. I have heard that it has been recommended to wash out
drains in Black Town by a pumping engine. I think there i
doubt, that a pumping engine with proper drains to the Sea,
effect the object with greater certainty than we, with such a
and such Rivers, could effect. And would suggest that as
opening of the Bar of the Cooum, or rather the keeping it ope
solely for the purpose of removing the ordure accumulated in
that engines together with public necessaries and sewers be e
ed in Triplicane and Chintadrepettah, and that the native
compelled to use them.

I have the honor to be, Sir,

Your most obedient Servant,

G. C. Collyer, Captain,

Civil Engineer, 4*th Divi*

Civil Engr.'s Office, 4th Divn.,
Sydapet, 6*th June* 1851.

From Captain J. C. Boulderson,

35*th Regiment N. I.*

To the Secretary to the Military Board.

Fort Saint George.

Sir,

I had the honor to receive towards the latter end of the m
of May your letter of the 29th of April last, and in compli

with the request therein conveyed, I have the honor to submit for the Board's consideration my opinion on some of the points regarding which information is required, those points are noted in the margin of this letter. Heads of subjects corresponding with those given in your letter under reply.

1. Improving the Course of the Cooum River.

The present course of the Cooum River is for drainage purposes good: but greater advantages might I think be had of the River than at present is obtained. The River runs along the low ground into which all drainage between the Mount Road and Choolay naturally flows. Choolay for easy drainage into the River is too distant from it, and the local situation of the place being low, the disadvantage occasioned by distance is much increased thereby: were however a cut carried north from the River near Colonel Law's Bridge, and thence as far as Cochrane's Basin, closely skirting Sydenham's Road, that disadvantage would be in great measure overcome, by that Channel also Sea water would reach that portion of the River west of Colonel Law's Bridge quicker and more freely than it now does [by the Canal and thence by the short cut between the Burying Ground Bridge and the River at Chintadrepettah,] the water in the River would be kept in a pure state longer and the drainage of Vepery and Choolay would thereby be rendered comparatively easy. Two good objects would be thus obtained.

Again, if the River was carried straight along the Coast by the Marine Villa [just west of it] to the Bar of the small River immediately north of Saint Thomé, instead of its being as now allowed to fall into the Sea at the Marine Villa, a very beneficial local improvement would be effected.

The drainage of the Suburbs Triplicane, Meersaibpettah &c. &c. of all the land in fact situated between Kutcherry Road, Mylapoor, the Mount Road on the north, and to the Cenotaph on the west, would fall into it, and besides being useful it would prove a pretty object to the eye, and the high Road between the Fort and Saint Thomé would then become a most delightful spot for the public to resort to for recreation. Although all the drainage of the locality named would fall into it, yet from the water being salt and in quantity, no bad smell, such as frequently rises

from the back-waters of the three small Rivers which now fall into the Sea between the Marine Villa and Saint Thomé would be experienced, the saltness of the water and the constant supply coming up the Canal from Ennore to take the place of that which is taken up by evaporation would prevent that.

2. Improving i. e. deepening its bed.

The Cooum River may be much sweetened by its bed being cleaned periodically. I do not think that the course I now recommend would deepen it much, the River would form its own bed again, it would keep its own level, but it might I think be cleaned at little cost and that more effectually when freshes are running off, by disturbing the foul soft deposit at the bottom, and so causing it to mix with the freshes and run off into the Sea, by any means that may be found best suited to effect the object, than by removing the deposit by hand labor during the hot season when the water in the River is low in the manner now practised.

Between Ashton's shop and the Village Chintadrepettah I think the course of the stream might with much advantage be slightly changed within its own bed by the construction of two or three groins of rough stone. At present the River infringes too much on the East bank [the Bund] under which it runs very deep, and the result is, the stone revetment is often undermined and portions of it fall down, and from the same cause also portions of the Road-way leading to Saint Andrew's Bridge, by the River bank from the Bund, is swept away and destroyed; and this occurs whenever freshes run out for any length of time with any thing beyond ordinary force and quantity. Two or three groins thrown out from the Bund into the River would prevent injury to either Bund or Road by forcing the body of the water more into the middle of the River bed.

3. Preserving a certain head of water all the year round by a more perfect communication with the Pulicat, Ennore Lakes and the Cooum River.

I do not think any public advantage can be gained by the bringing of fresh water into the Cooum. It would be by mixture with salt water rendered unfit for domestic [culinary] purposes and yet not salt enough to prevent its becoming putrid. It is much better for conservancy objects that the water in the River should be at all times as

4. Preserving a certain head of water all the year round by means of the Rivers round Madras within a circle of 20 or 30 miles being diverted into Tanks or to have Bunds thrown across them where sufficient supply of water could be remaintained to replenish the Cooum, the communication with Ennore being if necessary cut off.

salt as that which is in the Sea, for as long as an abundant supply of Sea water flows into the Cooum River no offensive smell rises from it, it is only when the Cooum ceases to be affected by the tides at Ennore, that the River stinks in the way it lately did. The Bar of the River at Ennore was then closing, that at Pulicat was shut, and the inlet of Sea water was not at that time sufficient to influence the Cooum so far up as the new [Colonel Law's] Bridge and the offensive smell from the River bed so loudly complained against was the consequence. I would therefore advise that measures should be regularly, yearly adopted to keep the Canal communication with Ennore as open and as free at all times as is possible.

At Ennore it would be expedient to remove if possible, the deposit of sand from the mouth of the River daily [by dredges, if they can be worked in the proper places with effect, the experiment has yet to be made] as soon as the freshes cease to flow out in order to prevent or at all events retard the closing of the Bar of that River, for when the Ennore Bar is well open then the supply of Sea water during spring tides is in sufficient force and quantity to supply the Cooum from the Marine Villa as far up as Ashton's shop and some times beyond it, and that is quite far enough for drainage purposes at the present time.

If a small supply of good soft fresh water for domestic purposes could by Canal be introduced into Madras from the large Rivers and Tanks, no doubt it would prove a very great benefit to all classes of the Inhabitants, indeed it would be an inestimable blessing to them, but it should be kept quite distinct from the Cooum River for reason before given. It would not do to introduce a large extra body of water into the Cooum, because the bed of that River is not too large now for the ordinary freshes that naturally fall into it.

5. Opening and keeping open the Cooum Bar so as to admit of the rise and fall of the tide.

I do not think it practicable to keep the Cooum River Bar open without the assistance of an extensive back-water. A back-water as large as that at Ennore and that cannot be had at Madras, for even if the waters of the Cooum and the Adyar

were joined,* still the back-water so formed would not have power sufficient to keep a Bar open.

It is the large body of water at Ennore which flows into the Lake by a confined narrow opening and out again through the same, the quantity flowing out being increased by the water falling in from the land that keeps that Bar open. Whenever the body of water which has to run out becomes less in quantity than that which flows in, then the Bar begins to close and such was the case for some time previous to the date on which the Cooum River became so offensive to the noses of the Inhabitants of Madras, occasioned by the water in the River being then low and the filth that had been collecting for many months, from that cause falling under the influence of the Sun.

I have the honor to be, Sir,

Your most obedient Servant,

J. C. Boulderson, Captain,

35th Regiment N. I.,

Civil Engineer to Her Majesty's

Madras, 9*th June* 1851. *Justices in Session.*

From Major J. T. Smith,

Engineers.

To Captain A. H. Hope,

Secretary to the Military Board.

Sir,

1. I have the honor to acknowledge the receipt of your letter of the 29th April, requesting information on the subject of the improvement of the Cooum River, and in reply thereto beg to state for the information of the Military Board, that the only point connected with the enquiry they contemplate which I have had occasion to study, is that referring to the practicability of keeping open the mouth of the Cooum by connecting it with the Pulicat Lake, which was examined by me and reported upon in 1839, and then appeared to be unadvisable in consequence of the very great

* By groins it is very probable a beach of sufficient extent might be formed up to admit of the waters of these two Rivers being joined by a Canal cut between the Sea and the houses now close to the Beach.

expense involved in the necessary works, and the very trifling results which would have been effected by them.

2. For these reasons I was of opinion that the third and fifth proposals mentioned in your letter would not be attended with advantage.

3. In regard to the other points referred to by you, I much regret that I am not possessed of any authentic data which would be serviceable to the Board, and in the absence thereof, will refrain from the expression of any opinions on the subject of their enquiries, as they have it in their power to avail themselves of those of other Officers of so much greater value than any I could offer.

I have the honor to be, Sir,

Your most obedient Servant,

J. T. SMITH, Brevet Major,

MADRAS, 12*th June* 1851. *Engineers.*

FROM MAJOR T. T. PEARS, C. B.,

Engineers.

TO THE SECRETARY TO THE MILITARY BOARD,

Fort St. George.

SIR,

I beg to apologize to the Board for having so long deferred a reply to your letter No. 2,703 of the 29th of April last. The circumstance of my having been occupied with an unusual press of business in my own office, will I trust be accepted by the Board as a sufficient excuse for the delay.

2. The Board do not, as I understand, expect that I should furnish any detailed, or definite plans for removing the nuisance complained of by the inhabitants of Madras in the condition of the bed and banks of the Cooum River. In noticing briefly the cause of that nuisance, and the nature of the measures which have suggested themselves to me as likely if not to remove greatly to abate the evil, I beg the Board will understand that I have never had occasion to make any accurate local observations; and that my opinions are based upon a general view of all the circumstances of this particular case; as well as upon some acknowledged general principles.

3. The chief cause of the abominable effluvia arising from the banks of the Cooum in the neighbourhood of Madras, is to be found in the influence always exercised by a dense population aggravated in this case by the peculiar habits of the people, habits which are not only offensive in the eyes of Europeans, but are, in fact, utterly incompatible with the health and comfort of the inhabitants of any large and populous Town.

4. The drainage of Madras, though much has been done of late years, is imperfect and insufficient throughout. The Cooum River may be considered as the main drain, and at the same time the natural source of supply to the entire system of drainage. This River may be described as taking its rise at the Cooum Tank which lies near a village of that name about 30 miles (as the crow flies) West and by South from Madras. A Channel from the Cortelaur River joins the Cooum near Perumbaukum, originally cut it would appear with especial regard to the supply of the Chumbrumbaukum Tank. This Channel has been closed for many years, and has only lately been re-opened.

5. Thus supplied the Cooum River pursues its course, draining a very limited extent of country. It throws off water here and there, in the usual manner to adjacent Tanks; and to secure a good supply to the Chumbrumbaukum Tank an Anicut has been built across the Cooum near Caratoor. Passing north of Poonamallee, it winds along a low and very flat country frequently inundating its banks: and at a point about 6 miles of Madras near the village of Treemungalum a large quantity of water is on all occasions of high freshes conveyed by a Channel into the watery nullah entering Madras by Peremboor. It then supplies the Spur and long Tanks, and finally reaching the Bar near the Fort finds space for the spread of its remaining waters about the Island, and along the Canal to the Ennore Lake.

6. This River as a means of bringing comfort and cleanliness to the people of Madras has been entirely neglected. We can feel no surprize at the complaints now made when we reflect that while in its course towards Madras it drains so many villages, its bed and banks being resorted to as places of convenience by the people, far from steps having been taken to secure the frequent scouring of its filthy bed, the stream when it does come down is

allowed to do all the mischief it can elsewhere. Tanks are burst —villages swept away—Madras as we have all seen may be inundated without being cleansed.

7. In very high freshes the river breaks over the Bar; an opening is made; and some cleansing takes place. In ordinary falls of rain and light freshes the stream passes slowly among the villages, enters Madras, washes Egmore, the neighbouring hamlets, and Chintadrepettah; and freighted with all it finds in those neighbourhoods it passes the Government Bridge, reaches the Bar, finds it closed, and turns leisurely round the Island and into the Canal depositing filth in numberless nooks and corners out of the reach of all subsequent scour. Thus Madras gets the benefit of it all.

8. The remedy for this great evil is two fold.

1st. Prevention.

2d. Cu[illegible].

9. 1st. [illegible] Prevention no doubt can exist of the expediency of providin[illegible] number of public necessaries or of improving and compl[illegible]ge of the most populous parts of Madras. The r[illegible] should be kept in order, highways where-ever practicable carried along them and all nuisances on the margin of the river and all discharge of Scavengers' carts within the reach of the stream put a stop to.

10. 2d. For cure we have to look chiefly to the River, to the improvement of its supply, and to turning that supply to better account. It is not improbable too that the tidal water may be brought to bear with better effect though its influence can never be very important here.

11. For the improvement of the supply of water in the Cooum I would suggest.

1st. That the cleansing and supplying the town of Madras be considered in this particular case a subject of primary importance; the irrigation of the country by means of the Cooum River being made subordinate thereto.

2d. That an Anicut be thrown across the Cortelaur at or near Casaveram (near Perumbaukum.)

3d. That no Channel be permitted to leave the River without a head sluice.

4th. That the stream be confined to the bed of the Cooum as much as possible; the banks being raised and strengthened where necessary, especially in the neighbourhood of Madras.

5th. That the stream on nearing the mouth of the River be confined to the one Channel lying under the Government House bridge, that its passage round the Island be prevented by closing the Channel near St. Mary's Burial Ground and by throwing an embankment across the reach opposite the Marine Villa, thus bringing the whole stream to bear at once on the bar. That branch of the Cooum which now runs at the foot of the glacis of of the southern face of the Fort forming the Island is probably due to excavations made to furnish material for the w[illegible]ks. Like the smaller Channel at the foot of the glacis on t[illegible]st face, it acts the part of an advanced ditch, and being, li[illegible]lso undefended it is, as all acquainted with Military S[illegible] a defect in the works rather than a useful adjunct t[illegible] As it concerns the present question it is a pos[illegible]-water ready to receive in deposit whatever fil[illegible] the Canal float into it. It might be gradually filled up with great advantage.

6th. Having thus obtained the means of husbanding and controlling the waters of the Cooum, I would recommend the construction of sluices to communicate direct with the Fort ditch and with the drains of Black Town, Chintadrepettah and Triplicane, all of which might thus be flushed whenever a sufficient supply of water come down the River.

Lastly, I would suggest the appointment of an active overseer as a sort of conservator of the River, who working for the benefit of the Madras public might be paid out of the Assessment funds but placed in a position subordinate to the Chief Engineer or other Government Officer.

12. Though I should not expect to add much to the efficacy if the tide in keeping open the Bar, I think it probable that the mea-

sures above recommended of confining the stream and preventing its wandering about the Island and into the Canal would produce that effect in a measure.

Driven into a narrow Channel the amount of tidal water passing over the Bar would be less, but the height to which the tide would rise at a given point, (say the Government Bridge) would be, according to the opinion of many experienced men, greater. The velocity of the ebb would therefore be greater, and might produce increased effect in scouring the Bar.

13. With regard to any works beyond the surf, I could not without much consideration and enquiry venture an opinion. That any work could be constructed to keep the river open all the year round, I consider very doubtful. That some might be so placed as to facilitate the maintenance of such opening by dredging or other artificial means, appears very probable; but I confess I should apprehend in any case an outlay of money far beyond any conceivable benefit.

14. I trust the Board will excuse my making one further suggestion upon a point which they might consider out of my province. As the best mode of arriving at a satisfactory solution of this question, I would suggest that authority be given to any Officer or Officers whom the Board may have at their disposal qualified to enter into the consideration of the subject to collect plans and particular information regarding the several Rivers which discharge themselves on this Coast. The object of such plans and reports, would be to show in each case to what extent and by what means either nature or art has effected the opening of the Bars. A collection of such plans and reports would be valuable in themselves; and would do more than any thing I can conceive to enable one to judge of the proper treatment of this River, and of the probable success to be anticipated from such treatment in this particular case.

15. From the extraordinary difference of opinion which the published reports exhibit among eminent Civil Engineers on questions of this difficult nature having reference to places with which they are all personally well acquainted, I think a reference to members of the profession having no personal knowledge of the

locality would fail to give the Board satisfaction commensurate with the expense, and that men of moderate scientific attainments and a fair practical acquaintance with the subject possessed of local knowledge and experience would be more likely to arrive at sound conclusions on the subject.

I have the honor to be, Sir,

Your most obedient Servant,

THOS. T. PEARS, Major,

MADRAS, 1st *July* 1851. *Engineers.*

P. S.—Having alluded in the foregoing letter to the expediency of constructing an Anicut across the Cortelaur it may be as well to mention that I have understood a project for an Anicut across the Palaur near Arcot will shortly be submitted to Government. In the event of that work being sanctioned the supply of water in the Cortelaur River will be greatly increased; that supply being as the Board are aware now mainly dependent on the surplus water of the Cauverypauk Tank, and therefore even now drawn, though in limited quantity, from the Paular.

THOS. T. PEARS.

FROM CAPTAIN C. BIDEN,

Master Attendant.

TO CAPTAIN A. H. HOPE,

Acting Secy. Military Board.

SIR,

With reference to your printed Circular bearing date the 29th of April last, which reached me on the 18th ultimo, I have the honor to forward you, for the information of the Military Board, such remarks and suggestions as my experience enables me to afford on some of those important questions to which you have called my attention.

1. The improvement of the Cooum River, as regards its course, the deepening of the bed and the preservation of a certain head of water all the year round, by a more perfect communication with the Pulicat and Ennore Lakes and the Cooum River, also the means of preserving a certain and permanent head of water

from the Rivers around Madras within a circle of 20 or 30 miles, comprise the principal objects in view.

2. As I am not sufficiently acquainted with the locality of the Rivers and Lakes to which you have referred, to enable me to suggest how all the important and desirable objects in contemplation can be attained, I will merely offer an opinion as regards the improvement of the Cooum River on some material points, and I have no doubt by deepening its bed and throwing a series of bunds across, that a great and a lasting benefit to the public would be accomplished.

3. If a small steam dredge could be obtained, the work of deepening the bed would be carried through with great success and celerity, but as the steam dredge boat now at Paumbam is too large to be got across the Bar, and as a suitable vessel could not be provided without much loss of time, I am of opinion, from what I saw in the working of the paddle boat dredge which was employed in the Cooum several years ago, that manual labour is preferable to that scheme, because with so active and hardy a class of people as the Tank-diggers double the amount of work, and twice the quantity of soil would be removed by their daily labour beyond what the dredgers ever accomplished in their daily progress.

4. With respect to the formation of Reservoirs by throwing bunds across the Cooum, I think there can be no doubt as to the utility of such a measure, but from what I have heard on this subject it seems essential to a successful result (so far as the beneficial purposes of irrigation may be in contemplation) that wherever bunds may be thrown across, it would be expedient that the nature of the soil on either bank, and in the bed of the River should be ascertained, because in the vicinity of the College Bridge, the soil is so impregnated with saline matter as to render the water there collected injurious to vegetation: this evil is, I imagine, only a local one, and I think higher up the River, where the bank is precipitous and where a clayey soil may be found by excavation, that Tanks or Reservoirs to a very great extent may be formed, and it appears to me that the upper Reservoirs may be so completed as not to require a flood-gate, because with a heavy fall and rush of water the torrent might safely be allowed

to run over the one bund, provided that the nearest bund to a Bridge was secured from the heavy pressure of a sudden inundation by that safe-guard which a well constructed sluice-gate would readily afford, and this plan of preserving the upper Tanks or Reservoirs would ensure the preservation of water to a very considerable extent, moreover should it be deemed advisable to throw bunds across the Cooum on any given point below the Bridges, each of those bunds should I think be provided with a sluice or a flood-gate. It will of course be indispensable to avoid all sandy or porous soil in the formation of these Tanks or Reservoirs as there are parts of the bed and adjacent banks of the Cooum where sand exists to a large extent.

5. As regards the opening and keeping open the Bar of the Cooum River so as to admit the rise and fall of the tide, I venture to say that the great objection to that scheme which now exists would be obviated by a number of bunds being thrown across as already noticed, and thereby preventing that great and lamentable waste of waters when the Presidency has, after a long drought, been visited by a bountiful supply. On such occasions it is impossible that the rush of pure water into the Sea, and the consequent drainage of so invaluable a gift can be contemplated with any other feeling than regret, and assuredly the prevention of a loss, so often witnessed, will prove an inestimable boon to the Public at large.

6. My attention is also called to the practicability of damming up other Rivers, Nullahs, &c. in the Vicinity of the Presidency, and I would earnestly recommend a due consideration to the Adyar and to every other stream which at present casts its overflowing supply of water into the Sea, where well constructed bunds would in like manner be found a successful remedy against that vast extent of waste during the rainy season.

7. I have suggested the expediency of allowing an overflow of water to take its course over some bunds, if such a plan should be adopted the ridge of those bunds must be impervious to a sudden rush of the stream which can, I imagine, be accomplished by layers of stone having as their main support from the inner basement, a quantity of rubble stone.

8. The sluices or flood-gates should be so constructed and

planned as to admit of their being opened without difficulty when under the pressure of a sudden torrent, and the Military Board have no doubt the means of ascertaining the most approved mode of constructing sluices by a reference to the Chief Engineer. I merely allude to this point in consequence of the faulty construction of some of the sluices attached to drains in Black Town.

9. I will now endeavour to furnish you with information on those points which are more intimately connected with my department.

In the first place, I have no doubt that the Military Board have already obtained the series of levels and soundings from the Government Bridge to the surf. I will therefore give you the information called for regarding the force and direction of the current, the effect of the surf on the Beach &c., The direction of the current is, in a very remarkable manner, governed by the force and direction of the wind, so much so, that I have known it change from a Northren to a Southern course and with an equal velocity within a few hours—this was fully exemplified in the Gale of the 4th and 5th ultimo—during the 4th, when it was blowing hard from the Northward the current set to the Southward at the rate of 3½ knots an hour, and when the Gale veered to the Southward the current shifted its course to the Northward, and very soon set in that direction at the same rate. It is therefore impossible to give the directions and average force of the current along the Coast during each month in the year with any degree of accuracy, because sudden changes and a longer continuance of the Southerly or a-long shore wind at one season than at another, precludes the means of making that calculation. I will however afford the information the Board requie according to the best of my judgment.

10. When the North East Monsoon has fairly set in, the current sets along shore to the Southward at the average rate of 1½ mile per hour, its maximum rate in ordinary weather may be estimated at 2½ miles, and its minimum rate at ¾ of a mile per hour, and this direction and force of the current may be reckoned upon from the 1st of November until the 1st of March.

In March and April, and sometimes until the middle of May,

Southerly winds prevail and then the current sets along shore to the Northward averaging $1\frac{1}{4}$ per hour. From May until the decline of the S. W. Monsoon in September, the current preserves a Northerly direction and is more or less in force according to the strength of the wind, but occasionally, when Land and Sea breezes are regular, there is but little perceptible current along shore, and I think the average set of current along the Coast during this period is not beyond half a mile per hour. In September and October, Southerly winds are again prevalent and the current (setting to the Northward) is governed by the force of the wind running at times full two miles an hour, and averaging $1\frac{1}{4}$ per hour.

11. There have been frequent instances of the shifting of the sand between the inner and the outer surf, and especially alongside the bulwark, and undoubted evidence of these facts led me to address the Marine Board twice on this subject—viz. on the 8th of January 1847, and the 21st of December 1847, when an exstenive and a long continued disruption of the Beach was the cause of very serious and embarrassing consequences, because the whole line of Beach which under ordinary circumstances had been available for commercial purposes and for the embarkation and landing of Troops, was washed away, and all communication between the shore and the shipping was forced from its accustomed limits, between the Tunnel on the South side and Clive's Battery on the North side, to a sandy Beach beyond the N. E. Bastion of Clive's Battery and near the village of Royapooram. Such a manifest hindrance and inconvenience to the mercantile and the public interests of the Port, induced me, in my communication to the Marine Board on the subject, to urge the necessity of soliciting that the Government would sanction the construction of a series of groins for the purpose of forming and preserving that continuous line of sandy Beach which is so essentially wanting to ensure the safety and facility of a direct and speedy communication between the shore and the shipping within the prescribed limits for the resort of Boats and Catamarans, and their plying to and fro, without delay or impediment.

12. The sandy declivity of the Beach is always liable to great and sudden changes in its formation, because a high and an irre-

gular surf, whether it is caused by a strong wind or a heavy ground swell, breaks through the sand and carries it away with every surge with such force and effect as to work a complete change within 24 hours. I have known an extent of Beach 20 yards beyond the base of the bulwark, where Boats could be laden and unladen with security on one day, and yet within 48 hours the whole of that available space has been washed away and the inner surf found beating against the very bulwark. The nature of the bottom from the inner to the outer surf in ordinary weather is loose sand, and the soundings taken at low water are as follows:

100	feet from the level of the Bulwark—dry sand.		
150	,, ...	$1\frac{1}{2}$ feet	Loose sand.
200	,, ...	$6\frac{1}{2}$,,	Loose sand.
300	,, ...	8 ,,	Loose sand.
500	,, ...	9 ,,	Loose sand.
600	,, ...	10 ,,	Loose sand.
720	,, ...	15 ,,	Loose sand.
840	,, ...	18 ,,	Hard sand.
900	,, ...	20 ,,	Hard sand.
1020	,, ...	21 ,,	Hard sand.

13. With respect to the site of a Break-water for the purpose of guarding the mouth of the Cooum from the effects of the surf, the nearer to the surf such a barrier could be erected the better, because the direction of the surf is not at all times parallel to the line of the Beach, when for instance it blows hard from the N. E. or the S. E. and the surf becomes irregular, huge breakers along the outer ridge of sand (which causes the outer surf) will deviate from a parallel course to an angle of from 5 to 10 and even 15 degrees, and upon those occasions, and still more so when it blows a gale from either of those quarters, the surf would sweep round the extremity of the Break-water, and be forced into that continuous line of surf then raging along the whole of the Beach. I am therefore of opinion that a Break-water, thrown out for the protection of the mouth of the Cooum, should be placed within 200 yards of the ordinary line of outer surf which would place it about 350 yards from the shore, and I think it would also be advisable to throw out a small but massive groin on each side of the entrance to the Cooum as a safeguard against a violent surge of the Sea.

14. The action of the surf on the Beach has an irresistible effect to throw and heap up a barrier of sand, because its influx has greater force than the recoil or reflux, therefore the only means of preventing that effect and influence is, I think, by the means of a Break-water so placed as to allay or subdue the action of the surf, and if on the one side the Cooum can be deepened, the Bar cleared by dredging, and on the other that a Break-water could be thrown out, then I should imagine the grand object of keeping open the Cooum River would be attained, and as all that is required is a suitable Channel for small Coasting Crafts and Boats there can be no objection to placing the Break-water as near as is practicable to the outer surf.

15. It is high water at the full and change of the Moon at 7h. 30m., and from my own observations together with all the information I have been enabled to collect, the average rise and fall of the tide at the full and change of the Moon is...... 2 6

	Ft.	Ins.
fall of the tide at the full and change of the Moon is......	2	6
And at quarters or during the Neaps....................	1	6
But the greatest rise and fall during the height of the North East Monsoon is..................................	3	2
The height of undulations in moderate weather is considered to be..................................	3	0
In a stiff breeze, the height may be....................	5	0
And in a Gale of wind it would reach to the height of....	10	0

The outer surf in a stiff breeze breaks at the distance of 150 yards from the shore, and during a Gale at the distance of 270 yards from the shore, but under ordinary circumstances, the outer surf is not beyond 100 yards from the shore.

16. As a remarkable effect of the great force and power of the ground swell in this Roadstead, I may call the Board's attention to the following occurrence, as published in the Asiatic Annual Register for 1808, page 128—9; to which I myself was an eye witness as I was living in quarters on the North Beach during the whole of one of the most violent hurricanes that ever assailed Madras, viz. on the 11th December 1807. "The Sea rose much "beyond its usual height, the surf reached Messrs. Harrington's "on the Beach and by its violence exposed four feet of the foun-"dation of the house: one side of the adjacent building the Naval "Office, (where I was residing) is much damaged, the Company's

"Rice godowns were forced open and much of their contents "washed away. The Sea rose close to the ditch of the Fort and "the surf dashed with violence over the ramparts. The counter "scarp at the North East angle gave way and the water poured "into the ditch at every rising of the surf. The bastion at the "Northern extremity of the Black Town wall gave way and two "guns were dismounted into the Sea &c. some idea may be formed "of the strength of the current and the force of the surf from the "circumstance of a large portion of the ribs of a ship supposed "to be the "Fairlie" which was burnt in the roads in 1799 were "thrown ashore close to Mr. Parry's godowns."

17. This is the remarkable fact to which I have alluded, the wreck thrown aground by the up heaving of the Sea was the entire bottom of a ship of about 800 tons burthen with iron kentledge on her floor, and I well recollect that many persons conjectured it was the remains of the *Malabar* burnt and sunk in six fathoms water in 1801, especially her Commander, Captain Kent, who happened to be at Madras during the gale, however this remakrable instance of so large and weighty a body of wreck being hove high and dry on shore should be taken into consideration when any great out work for the improvement of the Port is in contemplation, and it is very evident, that no other barrier than a well constructed Break-water could resist or oppose so tremendous a force.

18. Adverting to the general state and condition of the Cooum River and one of the well known causes of that offensive effluvia exhaling, when the water is low, from the mud and filth in the bed of that river. I would venture to recommend that its banks be made as perpendicular as possible and the mud cleared away from the edge of the banks, and it has often occurred to me that some useful hints may be taken from the manners and customs of the Chinese who never allow any thing to run to waste, and I think if they had the banks of the Cooum to deal with and all its defilements, they would keep a well organised band of Scavengers to carry away the filth with which those banks abound and provide a receptacle whence in due time it would be turned to a good account by making it subservient to the useful purposes of agricultural, and horticultural improvements.

19. Scavenger coolies with covered pails or buckets, carried banghy fashion, would by daily practice remove the most offensive deposits, and if some suitable retreat or reservoir could be allotted for such nuisances, economy and utility might in the end prove that out of an evil, some good would be found to result.

The stink, or Scavenger pails may be so covered as to be carried through proper Channels with as little offensive consequences as possible.

20. I have thus ventured to offer suggestions on a very important, and a very difficult question ; I feel emboldened to do so by the liberal views and motives entertained by the Military Board ; should any portion of this communication be found worthy of their favorable consideration I shall be much gratified, and if it occurs to the Board that my further services can in any way be found or made useful on such important objects as they have in contemplation, I beg that they will do me the favor of acquainting me therewith.

I have the honor to be, Sir,

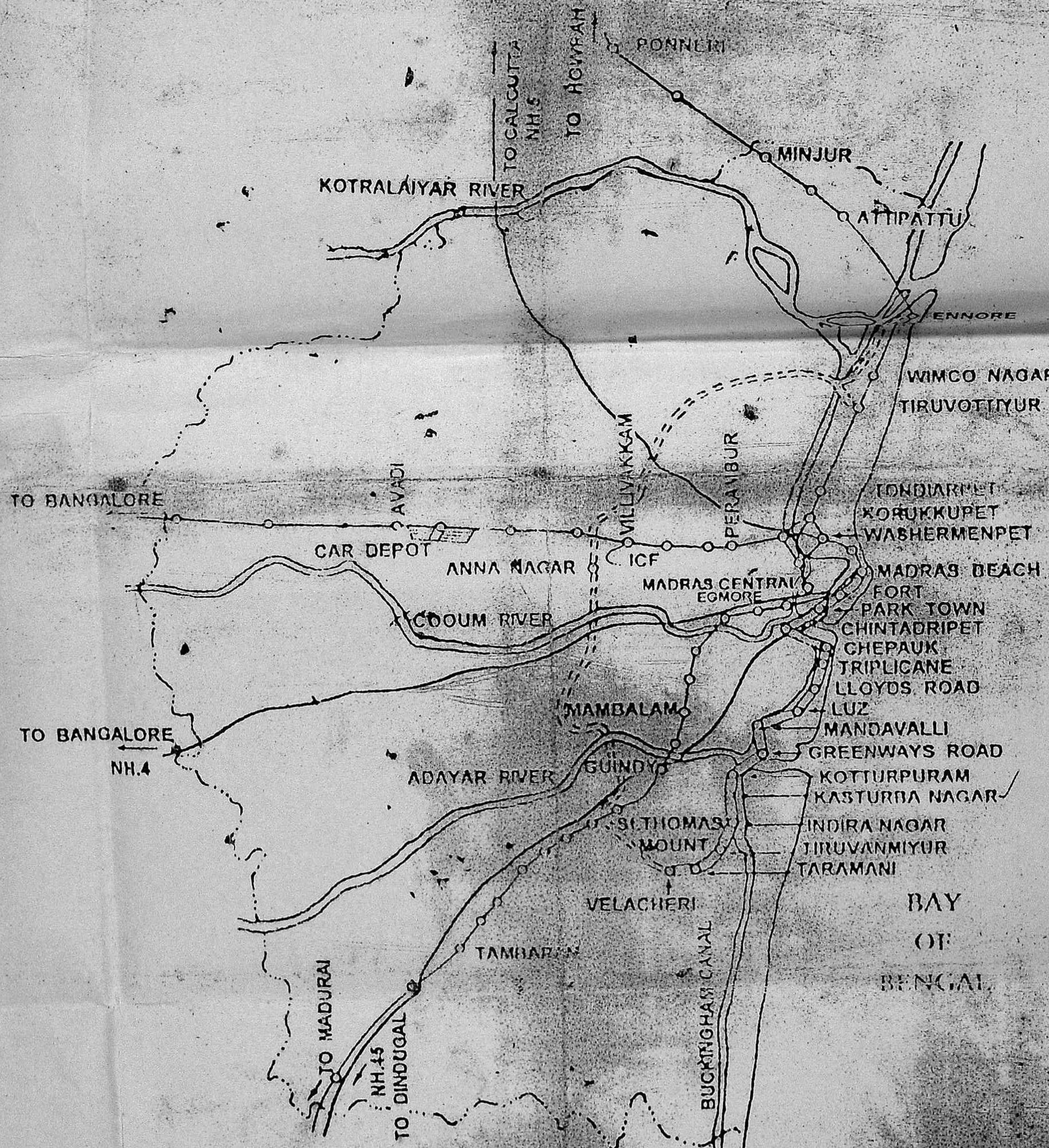
Your most obedient Servant,

C. Biden,

Master Attendant.

Master Attendant's Office,
Madras, 18*th June* 1851.

7


TO HOWRAH
PONNERI
TO CALCUTTA
NH.5
MINJUR
ATTIPATTU
KOTRALAIYAR RIVER
ENNORE
WIMCO NAGAR
TIRUVOTTIYUR
TONDIARPET
KORUKKUPET
WASHERMENPET
MADRAS BEACH
FORT
PARK TOWN
CHINTADRIPET
CHEPAUK
TRIPLICANE
LLOYDS ROAD
LUZ
MANDAVALLI
GREENWAYS ROAD
KOTTURPURAM
KASTURBA NAGAR
INDIRA NAGAR
TIRUVANMIYUR
TARAMANI
TO BANGALORE
AVADI
VILLIVAKKAM
PERAMBUR
CAR DEPOT
ICF
ANNA NAGAR
MADRAS CENTRAL
EGMORE
COOUM RIVER
MAMBALAM
TO BANGALORE
NH.4
ADAYAR RIVER
GUINDY
ST.THOMAS
MOUNT
VELACHERI
BAY
OF
BENGAL
TO MADURAI
NH.45
TO DINDUGAL
BUCKINGHAM CANAL